# Shifting between Economy and Cladding

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***Abstract:*** *This paper probes interior lining, specifically column cladding, in light of expansive definitions of economy. A student design project foregrounds the discussion in order to reveal prevailing design attitudes on ornament and structure. Those attitudes are reconsidered by the introduction of new fabrication technology. As these works supersede dichotomous relations between excess and austere, their formation suggests new working parameters for interior design in relation to ornament, craft and technology.*

***Keywords:*** *economy; column cladding; ornament; structure*

## Middle ground: Shaft

Originally occupied by the university library, Vol Walker Hall currently houses the University of Arkansas, School of Architecture. This inhabitation shift exposes poignant situations particular to the building's structure and spatial definition. A small annex sits on the back face of Vol Walker previously serving as dense book storage. Structure to carry the dead load weight of book volumes is provided in the form of industrial steel section columns formerly doubling as the uprights for shelving.

Despite considerable issues of safe egress, ventilation, lighting and heat, these stack areas are the current sites for a myriad of activities: offices, computer labs, media centre and storage for archives and outdated equipment. Since the horizontal element of the shelving system has been removed, each of these activities exists amongst a field of columns approximately 1800 mm on centre in either direction. Inhabitation is a function of negotiating an obstacle course. It is challenging to furnish these spaces. It is difficult to romanticise or wax poetically on consequences of industrialised members regulating a space so severely. However, students and staff often collide, run into, or simply crash into the columns while working in these spaces. It appears that the column spacing is at such a frequency to challenge or disturb our body's navigational radar. And yet, as the School of Architecture grows in enrolment and need for accommodating new staff, students and equipment, these under-utilised spaces are frequently eyed to be colonised, tamed and returned to purposeful status. Therein lays this paper's introduction to economy's role in interior design: 'the administration of the concerns and resources of any community or establishment with a view to orderly conduct and productiveness; the art or science of administration' (OED Online, 2003).

These very real parameters formed the context for a student design project housed in an elective paper dedicated to investigating historical and contemporary attitudes towards ornament. Seven upper level undergraduate architecture students and one art student attended this elective paper. Students' workshop and digital skills ran the full gamut. The list of architects included: Horta, Furness, Violett le-Duc, Voysey, Gaudi, Sullivan and Perret. While this author is conscious of the debate over using historical precedents for design inspiration, the assignment sought reference to historical works and philosophy in the spirit identified by Teyssot: 'The origin is not something that stands as an already given absolute, situated behind us in history; the origin…is the place where something is made to arise, with a 'leap' or 'spring' (Sprung)' (Teysott, 1987, p. 96).

Students investigated the philosophy of a notable architect practicing at the cusp between the Arts and Crafts Movement and the Modern Movement. At the same time they received instruction on how to operate the school's new fabrication tool, a 2 X 3.5 m bed CNC (computer numerically controlled) machine. These four territories – capitalising useable square footage, steel column sections, historic values on ornament, and an industrial routing machine – framed a pedagogical exercise. The students' effort informed my own research questions about the role and presence of ornament in contemporary architectural and interior design. While they addressed local conditions of column cladding, I was seeking evidence on how technological fabrication processes could assist to redirect pragmatic design concerns without deferring craft, ornament or material expression.

Students practised this speculative intent by designing new claddings for existing steel columns in a small exhibition gallery. Two rows of columns framed the narrow room. Like the fields of columns previously described, this room is difficult to inhabit because of the spacing and location of the columns. They are spatial antagonists.

### Fluting: Tack welds

The first cladding mock-ups for the gallery columns identified a critical misjudgement about structural steel elements: students assumed that if they measured one column and one bay they could save time drawing the site. Economy in this sense refers to 'an instance or a means of saving or thrift with reference to immaterial things such as time, personal ability, labour, …'(OED Online, 2003). Though their intentions to share information collectively were admirable, their assumption lingered until the moment of installation when a post-rationalised tolerance detail was required. Height varied nearly four centimetres amongst the ten columns. Whereas the students drew and thought about the columns as singular cross-shaped extrusions, each column proved in fact, to be a hybrid of welded flat bars. What was

assumed to be a high-end industrialised product turned out to be a series of one-off items with tremendous deviation along a single column length. Bay size was no less erratic. In a heated and heart-stricken moment when claddings proved to not fit, the students' underlying question was, 'What led us to make such foolish assumptions?' In defence of intelligence they recalled ways in which their architectural education introduced them to standard steel sections. Every drawing and reference they could find presented those 'hot, fast and heavy lines' as perfect and unadulterated by hand-craft or blemish of wear (Nonas, 1998).

The work of Mies van der Rohe yields the best lesson on this matter. Edward Ford gives credit to this architect's professional persona by reading the work through its material detail and what Ford saw as the designer's struggle to deal with revealing the intent of the work tacitly via its material circumstance (Ford, 1994). This observation arises from analysis of Barcelona Pavilion where the column is clad with chrome plated stainless steel and then in Mies' later work in America where steel sections are literally applied to the face of the building as extraneous to structure. In order to elevate the section to icon or ornament, the raw steel was ground and welded repeatedly to remove the blemishes of common steel production. In the end, these measures were both additive, excessive in order to express austerity. The narratives and innuendoes about Mies' allegiance to honest use of materials, ala Pugin, unravel as Ford exposes the degree to which Mies layers steel sections with hand-crafted labour and non-industrialised materials. Mies not only took advantage of industrial economy by working within its own system but he also formed a critique of industry's inability to form a work of art on its own accord. Mies understood that a free-standing column was an abstract formal element, more than a load-bearing element. So while steel mills could produce a multitude of sections based on engineering principles, the figure of the section, the profile and its material surface required further rendering in order to distinguish its relation to economy: to either pull the section towards a profane sense of craft and dwelling or closer to a classical sense of ideal. Wavering between dispensation and stewardship, this form of economy measures and weights the specifics of a particular situation and acts upon them as a community of factors (OED Online, 2003).

At the same time that Mies was working through means of fusing representation and intention, the Chicago Frame was liberating weight and mass of load-bearing walls. Economy quickly acquired an edge of efficiency whereby time, labour and materials became the motto of modern industrial production, especially in the context of American capitalist society. This characteristic of economy binds the process of making and the product or service. In other terms, the means coincides with the output. Economy-sized is an attribute 'designating

consumer products, services, etc, which are designed to be cheaper or more efficient for the customer' (OED Online, 2003). Such cost saving is in extreme cases referred to parsimoniously or niggardly and is most likely the single most powerful vehicle by which we culturally understand notions of austerity in design.

Students verified this notion when more than half of them declared huge reluctance and resistance to clad the existing steel columns despite their raw and crude surfaces, their mean intervention into the room and their neglect to meet fire code regulations. They so much wanted to embrace these strands of inert material and romanticise them as emblems of Modern or High-tech architectural design that they could not or would not, recognise the disparity between reality and what they subconsciously yearned for: contemporary translation. Even after goading them to grind an existing column into metal dust to test its formal and structural properties, they wanted to believe in Alberti's 'pulchritude et ornamentum,' beauty and ornament, which has been reconfigured over the centuries to rally against excess or necessary redundancy (Rykwert et al, 1989, p. 420).

The other portion of the student group insisted on working within ancient metaphor whereby building and body are analogous parallel entities. To this extent they were asking why the columns were naked/nude or without body. Despite efforts to steer this question into contemporary discourse about corporeal, virtual and formless bodies, historical reference to figural body could not be thwarted. The students, who embraced this mode of thinking, produced a large quantity of physical work simply because they had ready access to a referent form. The act of cladding easily lead to issues of modesty, dressing, concealing – all those fashionable ideas wafting through design studios in recent years. Such conceptual strategies alleviated the stigma of cladding as un-purposeful, useless or excessive in the derogatory sense of decoration.

The moment in history that architecture differentiated between that which was skeletal or structural and that which was skin, enclosure or surface a disparity occurred in spatial expression of the interior. In the masonry load-bearing walls of Gothic architecture, one finds structure and ornament at mutual coincidence with the production of space. In the curtain walls of contemporary architecture, the freedom to resolve physical form need not have any relation to structure – the structure is merely a frame from which to hang a technological textile. While Semper's writings on the primacy of textiles in architecture suggest a radical shift in the relation of structure to enclosure and surface pattern, this theoretical ground has yet to fully translate into the practice of building construction economy. With exception of a few very recent built works primarily realised with the aid of digital design, communication

and industrial fabrication, the structural frame stubbornly resists or dominates the three-dimensional profiles of interior lining.

Even Louis Sullivan grappled with this dilemma. While his buildings are noted for their transcendence of structure and ornament, the interior spatial expression is undifferentiated by deviations in the structural system except in the cases where it impacted the psychological expressiveness of the façade. Colin Rowe criticised the Chicago architects working at the turn century, Sullivan included: '…they limited themselves to producing buildings which should be no more than logical instruments of investment. In other words, being in no position to make manifestos in the cause of rationalism, they were simply obliged – and within the strictest terms – to be as rational as they might' (Rowe, 1985, pp. 98–102). In these terms we witness the allegiance between that which is economical and that which is rational, a union that in contemporary design practice is difficult to untangle or work outside of. Instead of embracing 'rational' as meaning expenditure of value or worth, or 'rational' as support of logic and thoughtful intent, 'rational' is automatically coupled and exclusively hinged to monetary cost.

With an economic imperative to save money and material, it is easy to understand why that which was absolutely necessary to hold a building up became primary and objectified. A very specific strain of economy infiltrated the domain of spatial interior. Thin material surfaces are wrapped around anaemic yet precise structural points. Design of interior space is in constant reference, reverence or friction with its own structural accommodation. Evidence of this shift can be found in the method by which architectural and interior design programs all over the world teach structural design. The structural design process as implicitly taught generally seeks the most efficient structural system, which typically results in stacked columns and floor plates subsequently stuffed with internal programmatic functions. While this may be harsh criticism, the structural frame, better known as the structural grid, over-rides spatial conception or material interface with spatial manipulation. Spatial presence can only exist in reference and in resistance to the dominance of that which technically makes it possible. But instead of finding structure celebrated, structural columns are just barely imbedded in walls, shoved in corners or disguised out in the middle of the space as 'features,' 'structural cadence' or 'rhythmic articulation of the structural frame.' These phrases were lifted from notes I recorded as a design studio guest critic at several schools of architecture and design in the United States and New Zealand.

## Line to mass

In the basement of Vol Walker Hall there lives an industrial monster, fondly nicknamed SOW. Having twelve nipples (maintenance lubrication spots), she is an alternative university mascot – a large three-axis CNC routing machine typically used for sign art but fitted to interface with architectural fabrication. At the time, University of Arkansas was one of only three architecture schools in the USA exploring the design potential in such industrial machines so the pressure to exploit the machine as a prototype design tool was significant in order to justify the cost. 'It is important to note that while this is a relatively new development in academic institutions and architectural practices, the use of these machines in material and commercial industry dates back to US military research in 1950, a fact detecting the notable lag in our ability to engage our own production!' (Callicot, 2001, pp. 3–20).

Files generated from CAD programs or other line art software are translated by interface software into 'ready-files' (.rdy), which in turn feed the routing machine with specific instructions on how to run 'the job'. Unlike conventional habits of using CAD software to draw graphically, this tool requires that students input data always in reference to fabrication: the material, the tool, and the sequence. As I established a machine training workshop for students, I started to witness the profound way in which CAD drawing software has infiltrated design methodology and altered the logic of describing, designing and producing physical environments. While a CAD drawing allows our drafting to look precise and did not falter if lines are unclosed, a CNC program reads unclosed figures as corrupt. This is a technical yet philosophical error message – a solid three-dimensional figure, a mass of material, is not abstract but has a body with closed parameters. At the same time, the interface software allowed us to replicate, layout, mirror and reverse figures to meet underlying anxieties about perfection: multiple identical copies through mass construction. The process of setting up a file became a process of analysing the intuitive/experiential method of routing in slow motion: reaching for the tool, selecting the bit, turning on the machine, cutting inside pieces, then outside pieces – ad infinitum.

'Many software designers believe that the tool metaphor appeals not only to ingrained outlooks about work, but also to deeper fundamentals of human psychology. Research proceedings on human-computer interaction include numerous works on cognition, mental mapping, psychological loads and psychomotor skills' (McCullough, 1996, p. 80).

As the machine is designed to handle high-level fabrication such as O-rings for NASA shuttles, it is necessary to set tool operations not by sight or by graphic calculation, but by

mathematical coordinates. Instructions and parameters are written in an industry language known as G-code. Students struggled with a new level of building and procedural tolerance, or rather, intolerance the machine had for their lazy habits. And because the machine did not come with a manual or an expert technician, our efforts were mostly trial and error. The percentage of error seemed to escalate whenever our designs neglected the pragmatics of making. Therefore claddings were far simpler than their initial ideas. We witnessed the complicity between economy and compromise.

## Section profile

Two works from this class succinctly illustrate the issues presented in this paper. The first one, designed and built by David Schmidt and Philip Rusk, is ground in body metaphor and research into the works of Frank Furness and C. F. A. Voysey. The existing column was regarded as a skeleton requiring mass or flesh. Literal rendering became a sculptural exercise requiring use of three-dimensional modelling software. Their design evolved from observing students leaning, hanging or propping themselves against the existing columns in the computer labs while they wait endless hours for printing access or hardware to complete tasks. Their proposal sought to increase this spatial practice by cladding the columns with protrusions that promote climbing through and amongst the field of columns. They wished to multiply the accessibility of three-dimensional space. The project ultimately rejected the minimal and economic face of the steel column as having any expressive architectural value.

A landscape topographical form was carved out of laminations of high-grade plywood. This act in itself was almost the students' undoing. While the CNC machine operates in three axes, the coarseness of each pass is determined by feed speed, rpm speed, tool diameter and material density. After fifteen hours of constant routing, David and Philip found they had another fifteen hours of hand-sanding to achieve a smooth fluid surface. The detail of binding the cladding to the steel upright with rope was influenced by George Hersey's discussion of column bases representing the bound feet of ancient Greek sacrificial bodies (Hersey, 1995, pp. 11–45). In this case, column cladding is the supplement of mass and figure, perhaps a critical restorative act that diminishes the existing column's minimal and abstract nature (see Figures 1, 2, 3 and 4).

Iova Dineva and Nan Kessler fabricated a column cladding that drew from their investigations on Victor Horta and Viollet le-Duc. Their design rendered the column visible via a shroud of vegetal pattern. They wrote, 'The emphasis of pattern in architecture, starting during the twentieth century, is expressed in the qualities of form, rather than familiar ideas through symbols, shapes and qualities derived from earlier structural prototypes. Specifically, while

*Figure 1: Carved virtual model*
*(Photography: Author)*

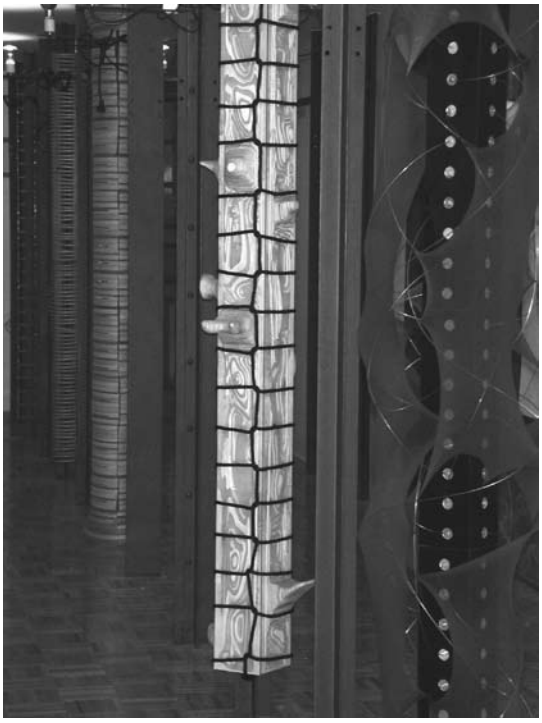

*Figure 3: Column cladding photo*
*(Photography: Author)*

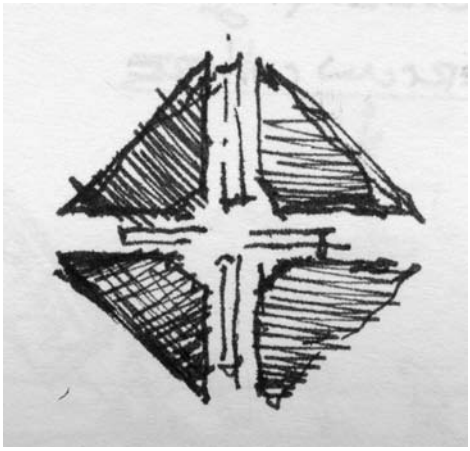

*Figure 2: Cladding sketch plan*
*(Photography: Author)*

*Figure 4: Protrusion details*
*(Photography: Author)*

ornament in the Art Nouveau movement was based on floral and other organic forms, it consciously veered away from ornament as imitation. Contemporary materials and processes were used to translate botanical forms into patterns that respond to functional and structural requirements' (Dineva & Kessler, 2001).

Their final installation was a box of small acrylic parts that snapped together like a scale-model airplane kit to form a translucent wrapping. This was an exercise of exhaustive and excessive repetition that took full advantage of the CNC machine's power to make hundreds of delicate parts. Unlike the previous cladding that developed complexity from program software, this project had a simple cookie-cutter file that produced many two-dimensional pieces. All shapes and edges were devoted to developing an overall floral form.

In the end, the cladding illuminates the steel section in minimal scaffolding. The column is exposed but veiled. Gevork Hartoonian wrote: 'Horta's columns are not classical, nor do they anticipate the modern perception of a column, a non-figurative white cylinder. Yet like Frank Furness, Horta connotes the idea of 'beginning': He sees and constructs the column according to the structural and formal potentials of iron. One might speculate that Horta conceived of architecture through the haze…surrounding the life of the industrial city and the perceptual domain offered by new technologies' (Hartoonian, 1997, p. 126). This is confirmation of the students' success to translate their research into design. A level of abstraction is maintained yet the column is visually and physically more fragile (see Figures 5, 6, 7, and 8).

Both projects disturbed the students' sense of economy. Their working equations towards time, money, material and labour were far from efficient. Instead, expenditure became relative to the goal and the process of making and designing simultaneously.

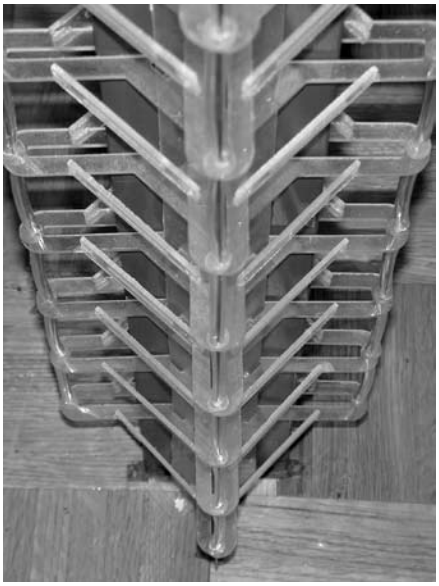

*Figure 5: Small acrylic parts*
*(Photography: Author)*

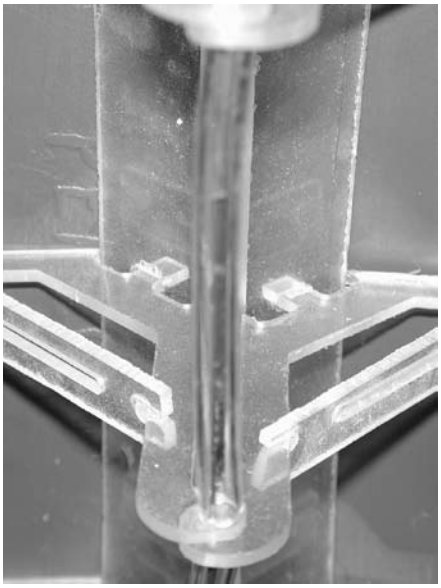

*Figure 6: Column cladding photo*
*(Photography: Author)*

*Figure 7: Flat, floral and yet three dimensional*
*(Photography: Author)*

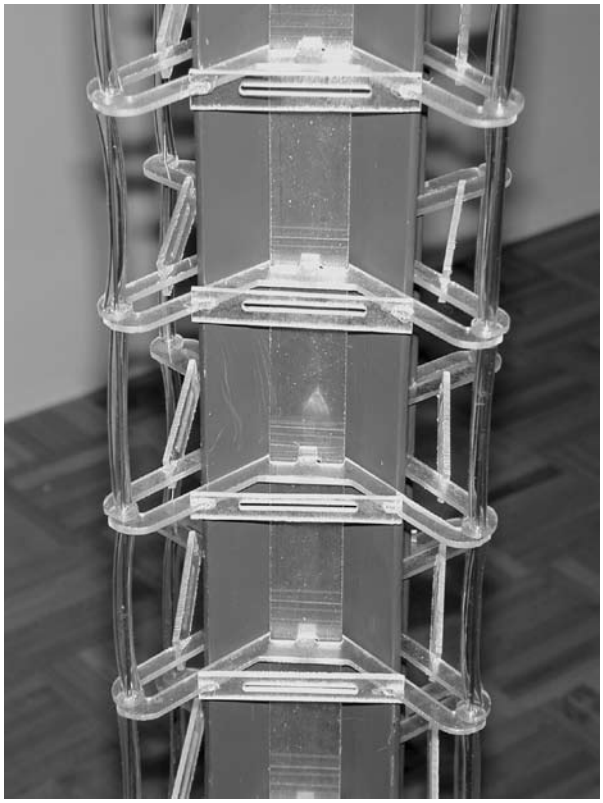

*Figure 8: Scaffold*
*(Photography: Author)*

## Entasis and consequences of G-code

'The desire to realise unique objects and constructs continues to be shared by designers and manufacturers alike. Our desires to customise the environments and products of our world is a human one; so perhaps the techniques that realise this ought not to be classed simply as industrial tools, but rather as an extension of an existing medium of expression. By striking at the previous limiting conditions of standardised mass production, computer-aided manufacture allies the idiosyncrasies and surprises of design tantalisingly close to the realities of production' (Callicort, 2001, p. 20).

Albeit ambitious in scope, the student project to design column claddings in Vol Walker Hall tested each student, their education and their cultural environment. In truth, none of the columns fully addressed the problem of inhabiting the column-filled spaces of the building.

However, the findings are not relative or murky. New working parameters for interior design in relation to ornament, craft and technology are implied:

a. We were able to ascertain that conditions of ornament through pattern, embellishment, and accessory are alive within creative speculation. They are not disparate to the forces of industry. Material and theoretical notions of surface even as smooth, homogenous products of modern technology readily offer a site for ornament to spawn.

b. As well, historic positions regarding industrial processes of mass production were reconsidered. While uneconomical in terms of labour, the students' integration of the CNC machine with the design process reveals significant promise for hand-craft to merge or become hybridised with machine fabrication. 'Tightening this loop between conception and execution has the potential to reconcile some of the separation of design and fabrication that industrialisation had previously imposed on craft' (McCullough, 1996, p. 178). We realised that this tool, as well as other CAD-CAM equipment, helped us to confront profound issues of communication, representation and fabrication across and within our discipline of design and construction as well as between our own hands and intentions.

This paper vacillates between structure and ornament, hand and machine, and material and process. In doing so, it does not come to any particular conclusions or truths about these issues but points to a shifty or shifting economy in contemporary interior design. Fabrication is relieved from nostalgic perspectives of historic origin and preyed loose from the strong-hold of industrial imperatives. These observations are not curious or unusual. The provocative notion is found in the students' design work. Their design and fabrication of cladding structural columns uncovered historical architectural underpinnings regarding industrialised processes, craft and conceptual expression. Through their own digital means, virtual and hand, these students traversed complex territory about technology and ornament, a conversation that continues to preoccupy design theory and practice. These small steel sections provoked a working discourse about economy. Lurking in the margins of these findings is the ever so demanding condition of economy. It is not as simple as abiding to dictums of 'Less is more,' or 'More is less.' Not always found in the output, economy can often be located in the planning and preparation for something to occur. Economy is not solely monetary expenditure but an environmental assessment of community. This is ever so relevant to the spatial interior.

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